

E907 Offline Status

and some thoughts on what
our needs are for the upgrade

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MIPP Upgrade Collaboration

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MIPP Offline Software: An Overview

- The MIPP offline software is currently based almost exclusively on C++ (the exception is the GEANT3-based MC)
- We make use of several external packages:
 - Root (<http://root.cern.ch>)
 - Xerces C++ (XML parser) (<http://xml.apache.org/xerces-c>)
 - Postgres (Database) (<http://www.postgresql.org>)
 - CERNLIB/GEANT3 (MC) (<http://cernlib.web.cern.ch/cernlib>)
 - Fluka (MC particle fluxes) (<http://www.fluka.org>)
 - CVS (software version control)
 - Software Release Tools (SRT, for code release management)
- Another external package *may* also be incorporated: RecPack, a Kalman-filter based track and reconstruction package

MIPP Offline Software: Looking towards the future

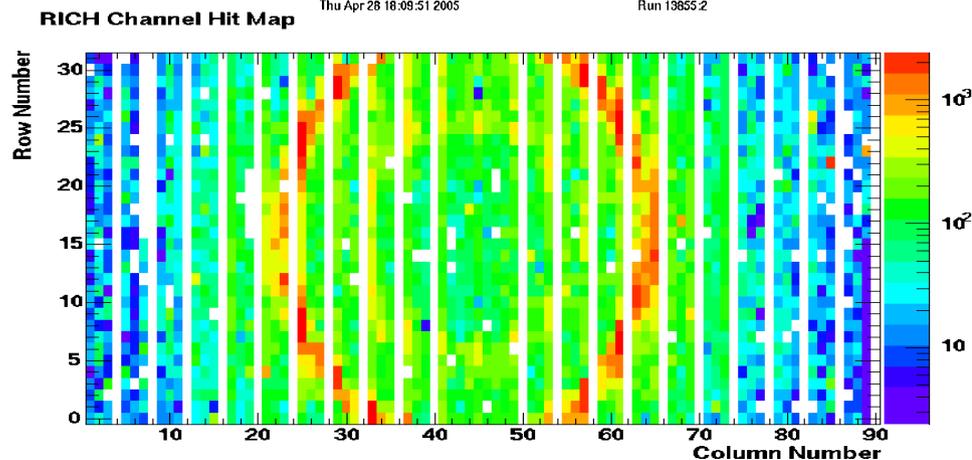
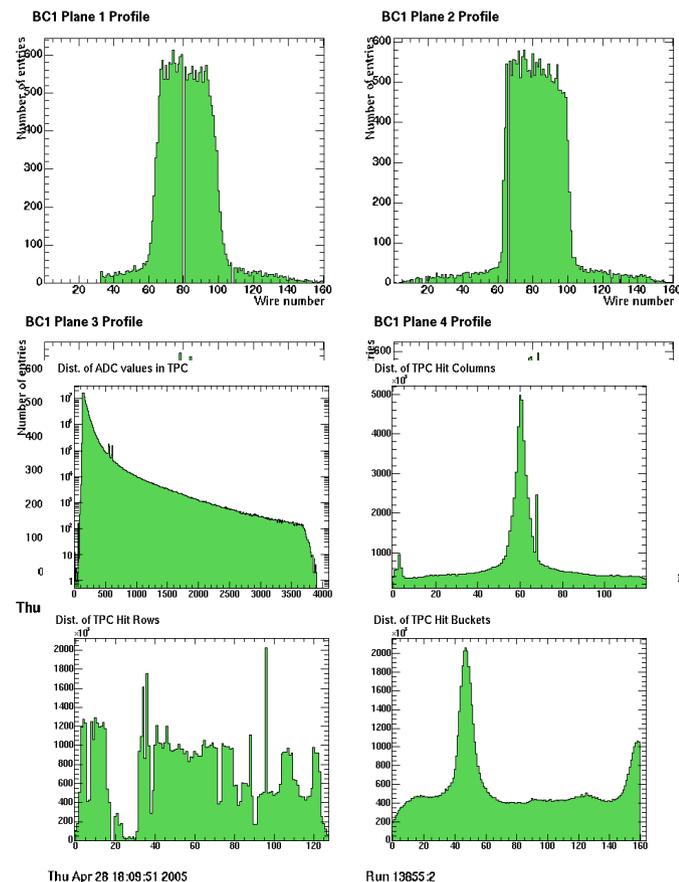
- RecPack: Kalman-filter based track and reconstruction package, depends on CLHEP.
 - <http://evalu29.uv.es/recpack>
 - <http://wwwasd.web.cern.ch/wwwasd/lhc++/clhep/>
- FMWK: simple framework for data analysis and reconstruction... derived from the current MIPP framework, now generalized for public use.
 - Used by SciBoone and NOvA.
- GEANT4?

Data Format

- A “raw” data file format is used by the DAQ that allows for fast instantaneous write speeds.
 - Data from each detector is stored in a raw data “block”.
 - New detectors will need to define the format for their own block.
- The reconstruction software depends on a Root format of the raw data, so an extra step is required to convert the raw data file to a Root data file (raw2root stage).
 - Raw data from each detector is stored in a Root file as “digits”.
 - New detectors will need to write the code to unpack their raw data into a Root format.
- Due to increased data rate, I think we will have to continue using this approach for the upgrade.
 - Other option is to use a farm...

Online Monitoring

- Stand alone program “onmon” processes raw data file and displays detector data quality and status.
- Was run in control room and accessed data files across NFS mounted disk.
 - With increased data rate we may not be able to keep up.
 - No reason why we should not be able to reconstruct events in (semi-) real time.
 - Plot reconstructed vertex, beam momenta and K0 mass distributions for each run/subrun?
 - We will want to re-think what, how and how much to display.

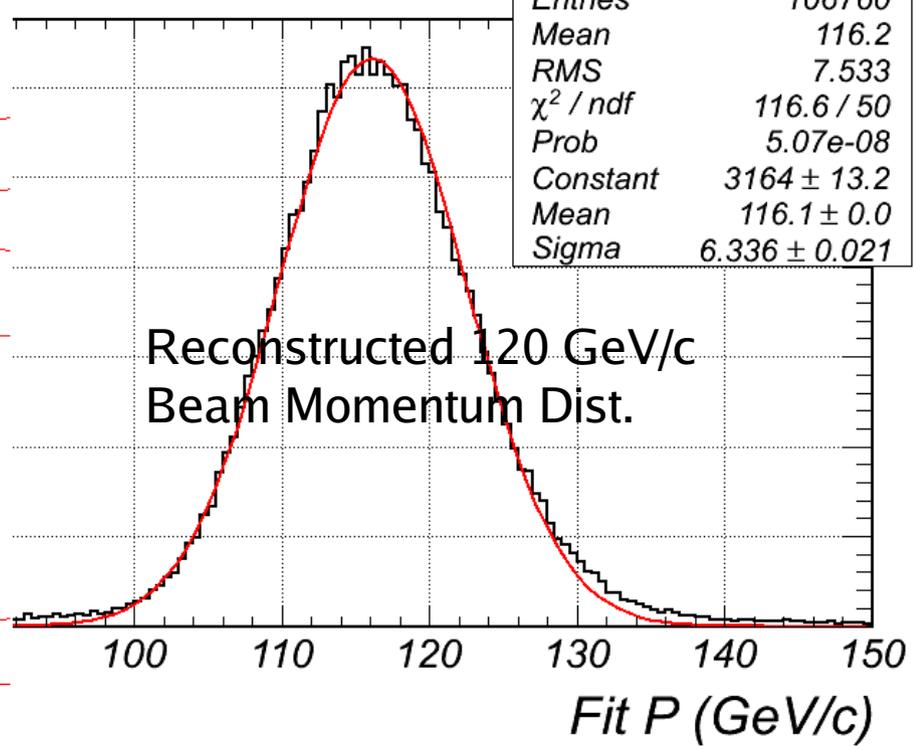
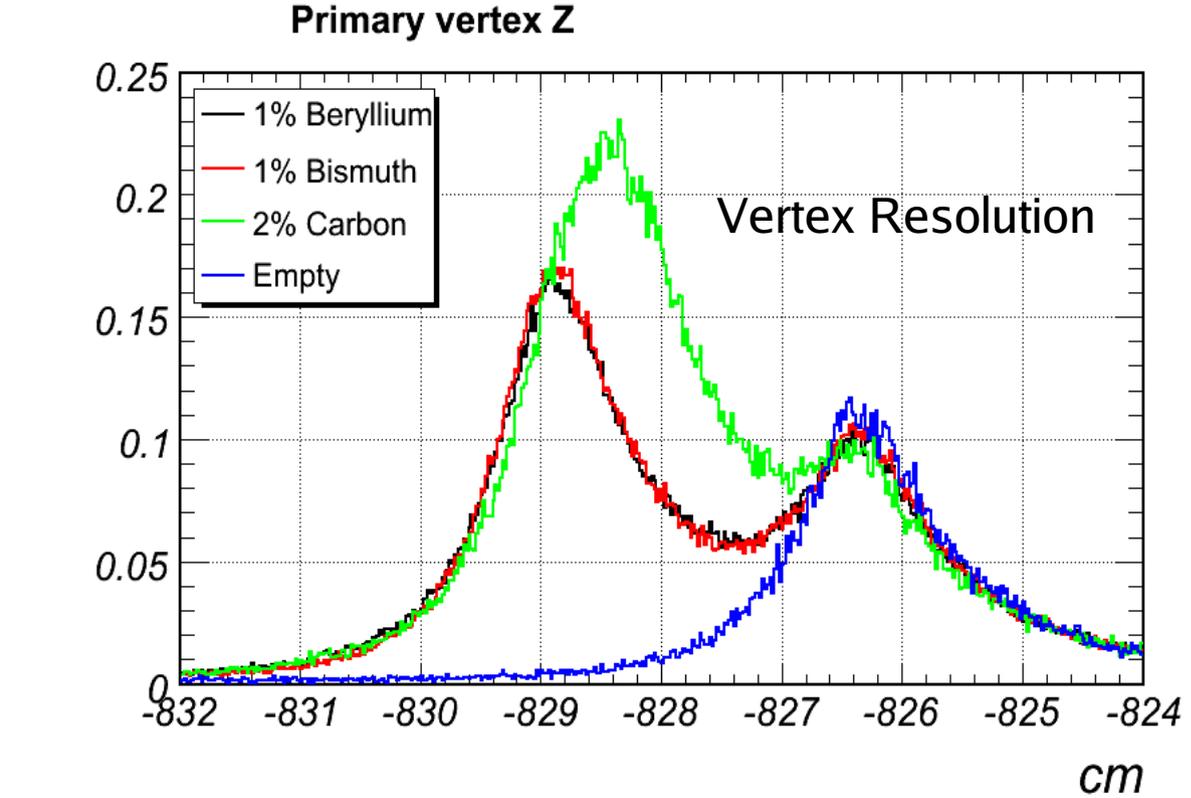
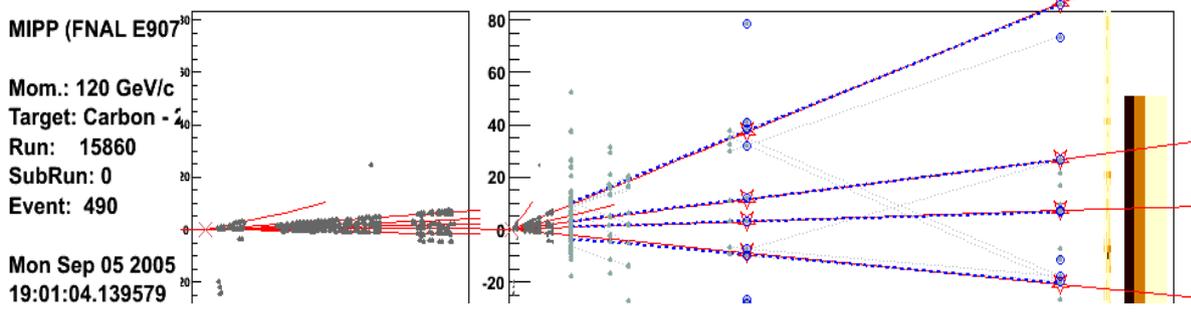
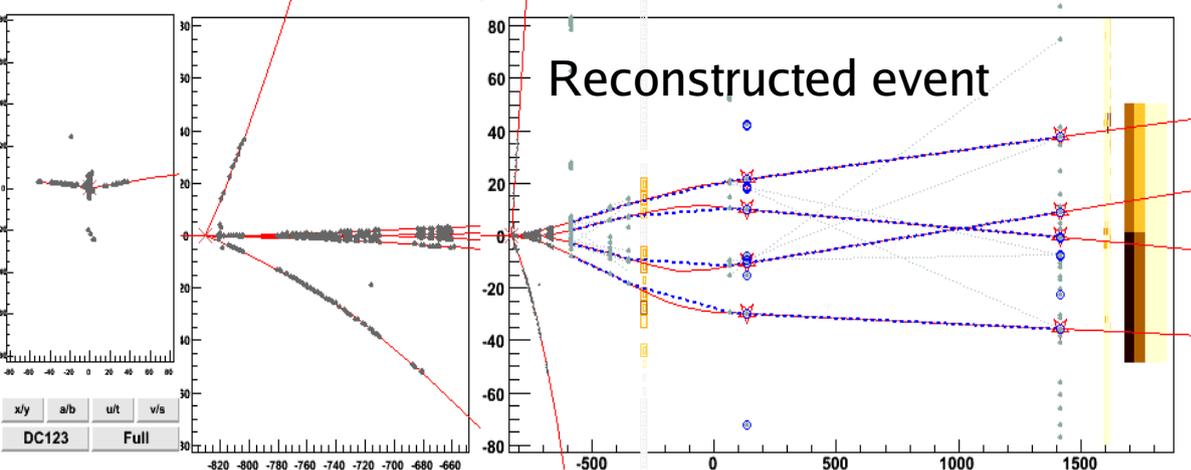


Monte Carlo

- GEANT MC is in pretty good shape.
- Digitization for individual detectors still needs attention:
 - DCkov digitization is non-existent
 - DC timing distributions need work
 - In general more tuning needed to match MC raw data to real raw data
- MC is too clean
 - Pileup tracks/events?
 - Dead/noisy channels (this is already done for RICH and TPC)

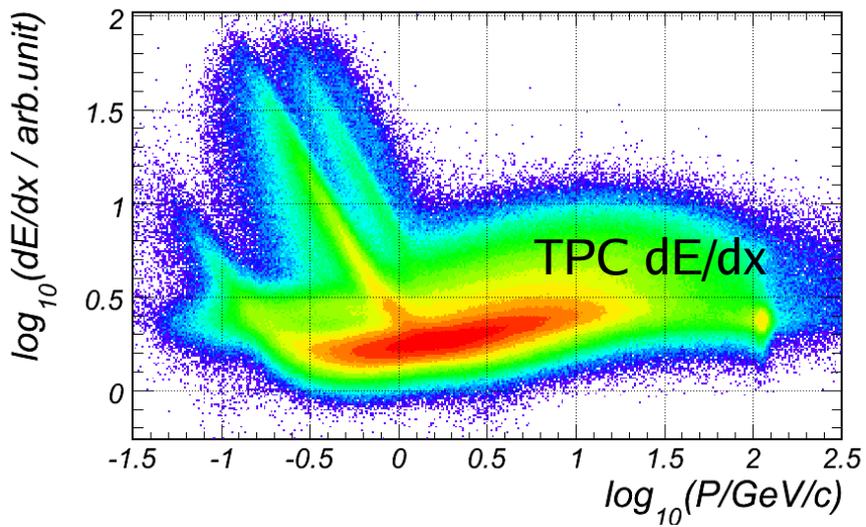
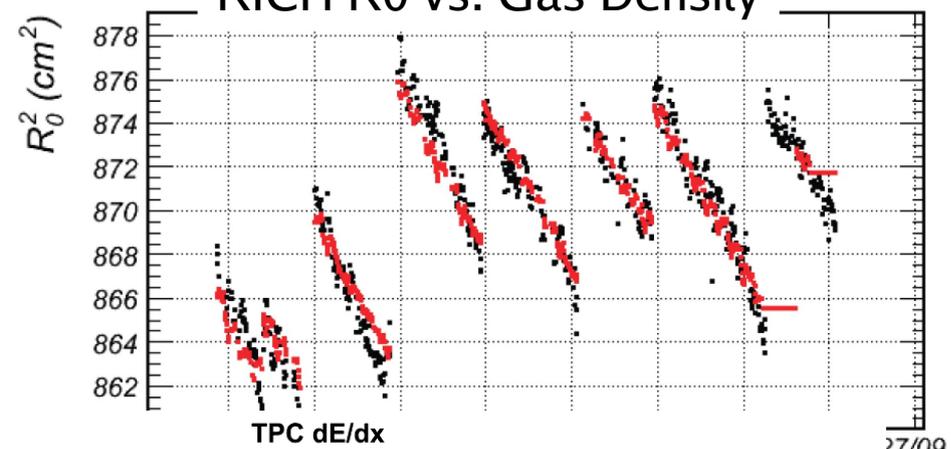
Reconstruction Status

- **Current track and vertex reconstruction:**
 - Incoming beam track trajectory determined from beam wire chamber hits.
 - Track segments formed from Chambers 1-3 and Chambers 4-6.
 - TPC track segments formed from TPC hits, assumes homogeneous B-field.
 - DC and TPC track segments are merged and fit to template tracks (which are formed from measured B-field maps).
 - Vertex-finding done via deterministic annealing filter (DAF).
 - Vertex-constrained fits done with seeds from DAF fit.
- **Current PID:**
 - Beam track PID determined from BCkov.
 - Secondary track PID:
 - RICH is in good shape
 - TPC dE/dx is almost ready
 - CKov and ToF are still works in progress

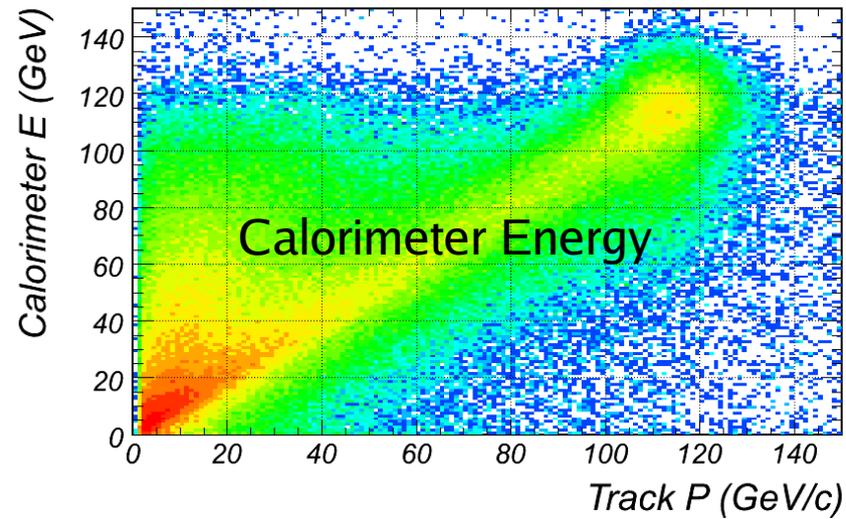


- Reconstructed MI 120 GeV/c beam momentum is ~3% low; resolution is ~5% at 120 GeV/c.
- Vertex resolution is ~8 mm. Target out data used to correct for interactions in scint instead of target.

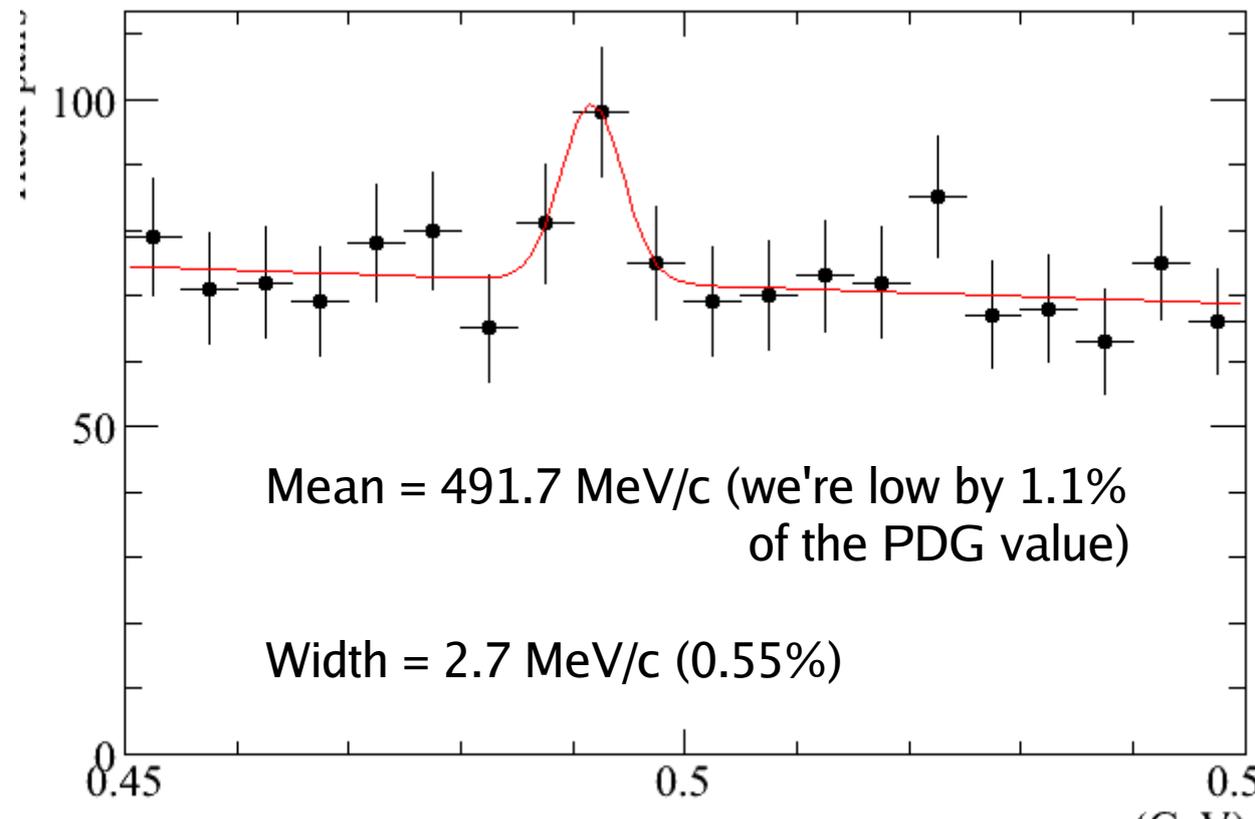
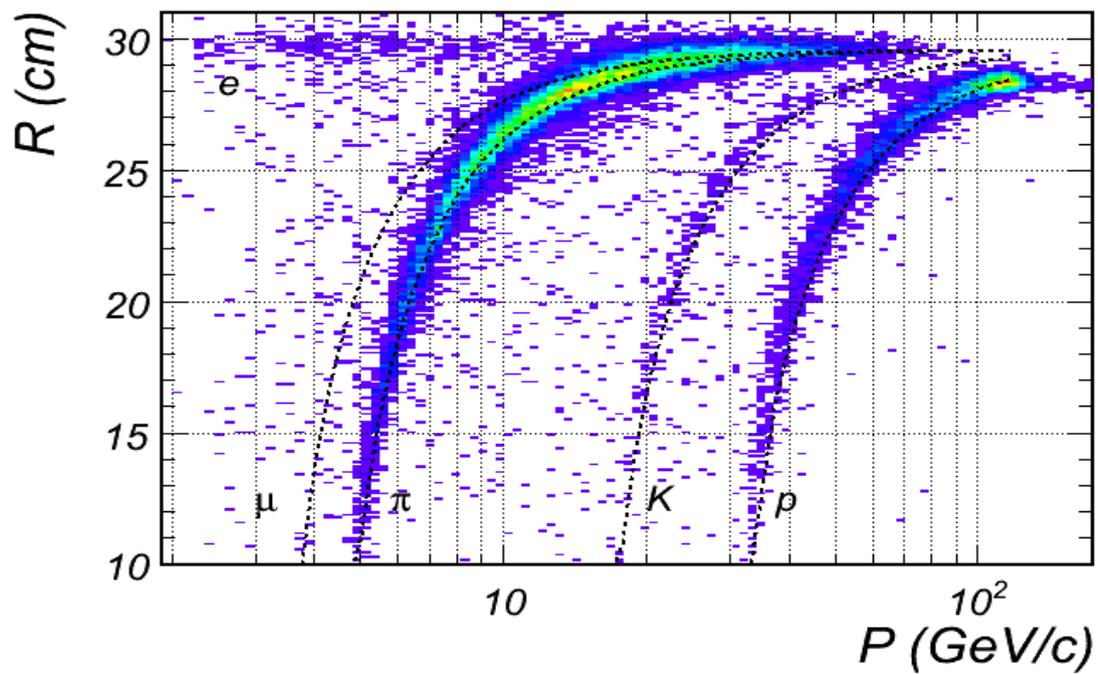
RICH R0 vs. Gas Density



Calorimeter energy vs Track momentum



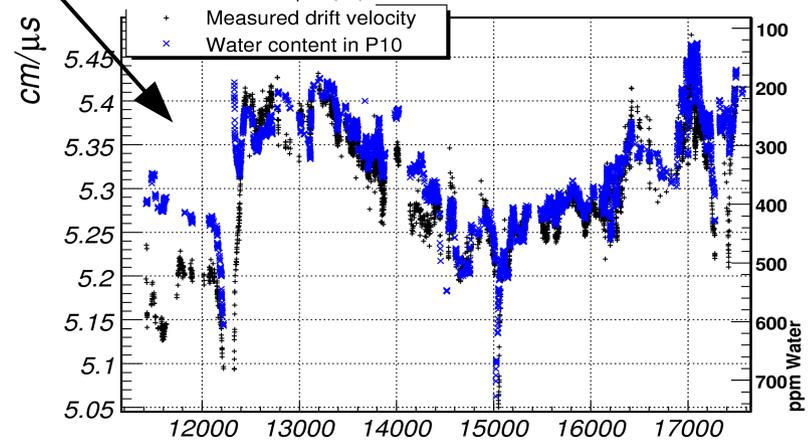
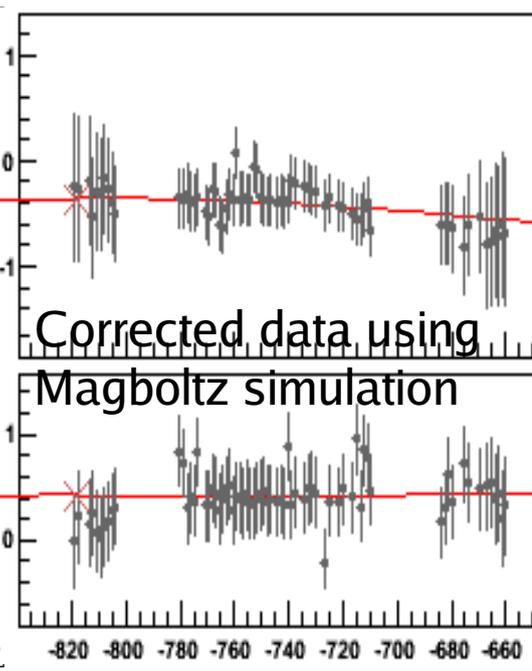
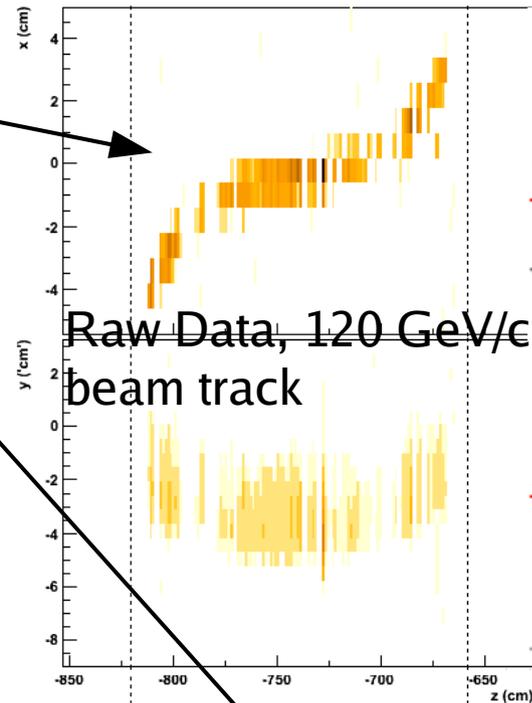
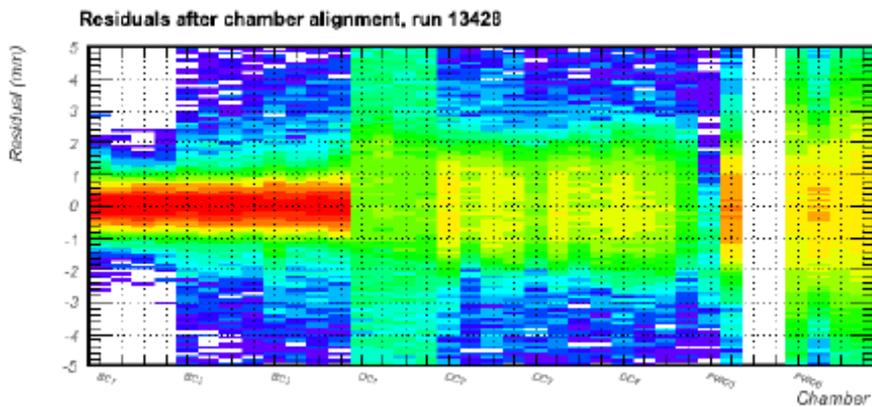
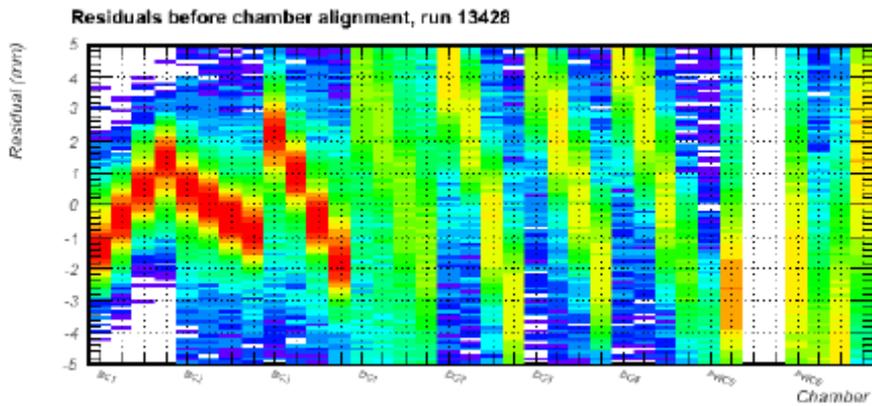
RICH ring radii, proton-Carbon at 120 GeV/c



Reconstruction Issues

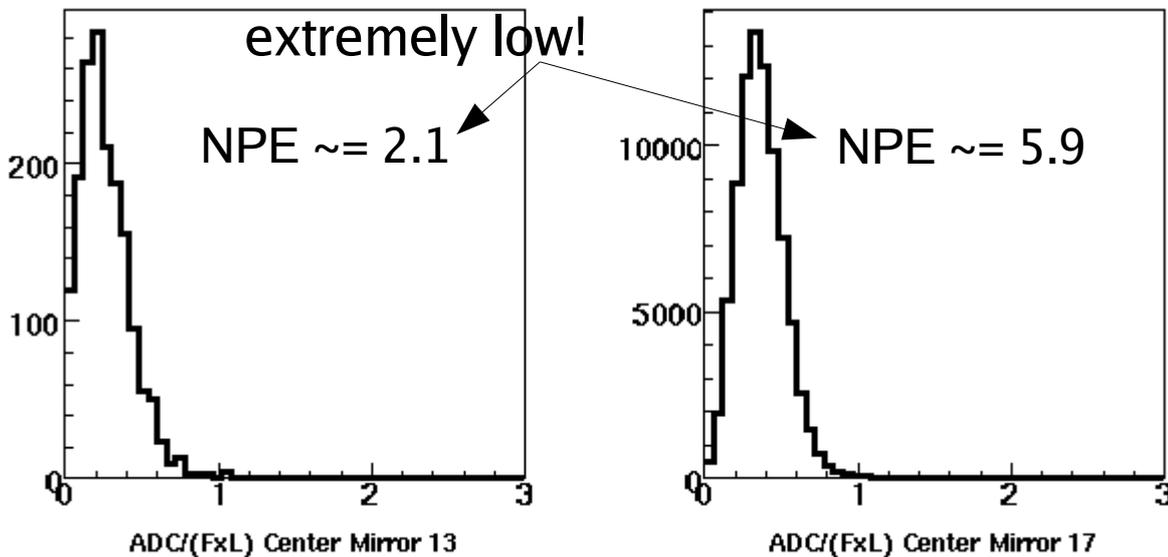
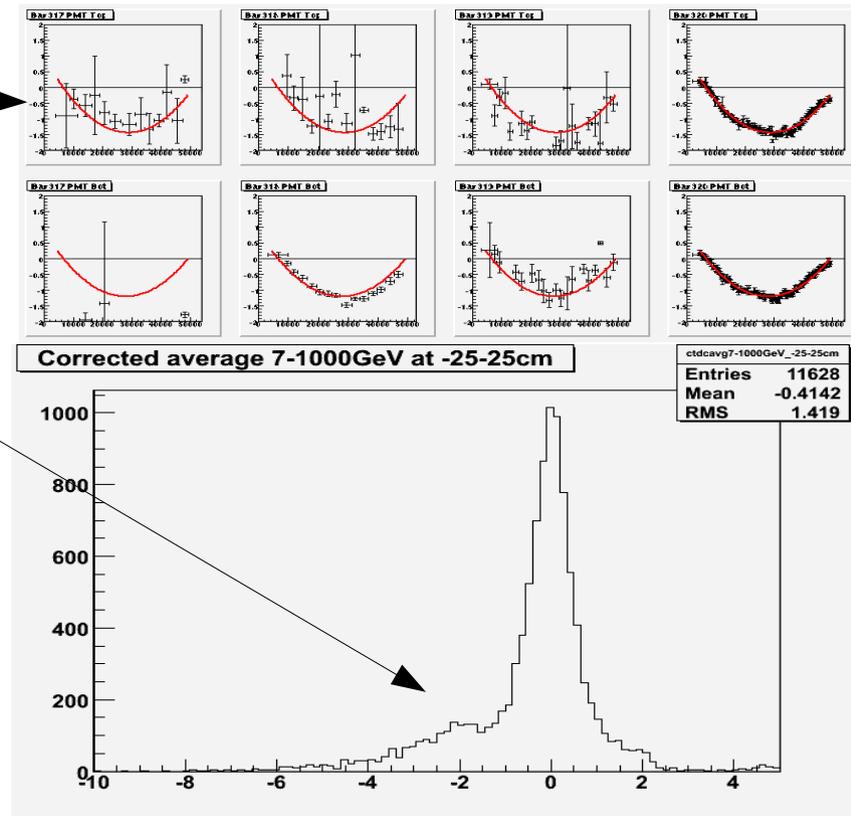
- Although our reconstruction is in pretty good shape at this point, there have been several stumbling blocks:

- ExB effects in the TPC
- TPC drift velocity calibration
- Alignment



Reconstruction Issues

- Remaining issues:
 - Track reconstruction needs to take MS and dE/dx into account
 - Specific algorithm for secondary vertex finding?
 - ToF PID
 - Temperature dependence in timing
 - Superluminal tracks?
 - Ckov PID
 - Number of pe's per b=1 particle is



Reconstruction Needs

- Really, not much new code is need in terms of reconstruction, however:
 - Plenty of room for improvements in track and vertex reconstruction algorithms:
 - Kalman-filter
 - Improved resolution of chamber hits (need to make use of timing information)
 - Secondary vertex finding
- Field-off data has been invaluable, but we have very little of it from MIPP I. I strongly recommend we take more next time!

Reconstruction Needs

(continued)

- But what we *really* need is more people!
 - All effort in track and vertex reconstruction has come from a few people over the past 3 years.
 - We need people or groups to take ownership of the reconstruction/calibration for some of the individual detectors (TPC, Ckov, DCs)
 - We need someone to be in charge of alignment

Analysis Status

- Andre Lebedev (Harvard) working on a measurement of secondary K/π and π^+/π^- ratios from 120 GeV/c protons on thin carbon target above 20 GeV/c (where we have PID for RICH).
 - Ratios in this energy region will help MINOS constrain their predicted Fluka flux in their high energy tail.
 - He will defend his Ph.D. thesis in a few weeks, after which we lose him.
- Sharon Seun working on a measurement of similar ratios (and perhaps fluxes) from the MINOS target.
- Nick Graf working on a precise measurement of the charged Kaon mass using the RICH data.
- Immediate goal: first flux measurement for the 120 GeV/c protons on the MINOS target by the end of the summer.